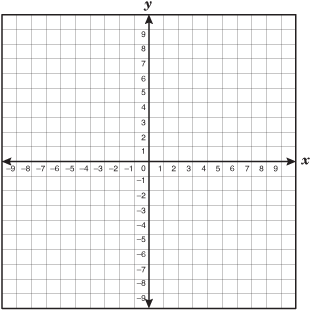
**Unit 2: Analytic Geometry**

**Lesson 2: Length of a Line Segment**

**(x, y) = ( x1 + x2 , y1 + y2 )  
 2 2**

Example 1: Calculate a Length

To make round parts, programmable machine tools often use a coordinate system with the origin at the centre of the part. How far apart are the centres of the mounting holes A and B in this cam? The coordinates are in centimetres. Round your answer to the nearest tenth.



Run

Rise

Applying the **Pythagorean theorem** gives AB2 = run2 + rise2  
AB = √ (x2 – x1)2 + (y2 – y1)2  
 = √ (-3 – 2)2 + (5 – (- 4))2  
 = √ (-5)2 + 92  
 = √ 106 = 10. 3 The centres of the mounting holes are about 10.3 cm apart.

Example 2: Compare Distances

An air ambulance service uses a grid system to help estimate flying times and fuel requirements. Coordinates on this grid are distances in kilometres east and north of a reference point on the lower left corner of a map of Northern Ontario. A helicopter ambulance picks up a patient at point P (96, 197). The nearest hospitals that can provide the treatment the patient needs are in Timmins at T (200, 296) and Sudbury at S (232, 80).

1. Which hospital should the helicopter take the patient?

**First, find the distance to each hospital.  
  
For Timmins hospital: For Sudbury Hospital:**

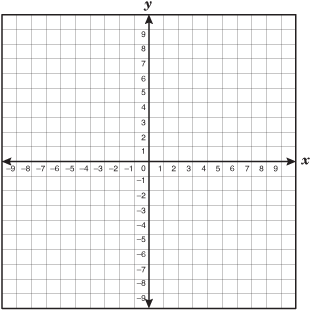
**PT = √ (x2 – x1)2 + (y2 – y1)2  PS = √ (x2 – x1)2 + (y2 – y1)2  
 = √ (200 – 96)2 + (296 – 197)2 = √ (232 – 96)2 + (80 – 197)2  
 = √ (104)2 + (99)2 = √ (136)2 + (- 117)2  
 = √ 20617 = √ 32185  
 = 144 = 179  
  
Therefore the helicopter should got to the Timmins hospital because it is closer to the pick-up point.**

1. List any assumptions you made for the answer

The decision to go to the hospital assumes that the helicopter can travel in a straight line to either hospital. The decision also assumes that weather will not affect the flying times or prevent a landing at the closer hospital.

Example 3: Find the Length of a Median

Find the length of the median from P for a triangle with vertices P ( - 2, - 2), Q ( 7, - 1) and R (1, 5)



R

Q

P

**(x, y) = ( x1 + x2 , y1 + y2 )  
 2 2  
 = (7 + 1 , - 1 + 5 )  
 2 2  
 = (4, 2)  
Now substitute the coordinates of P (-2, -2) and M (4, 2) into the length formula  
  
PQ = √ (x2 – x1)2 + (y2 – y1)2    
 = √ (4 – (- 2))2 + (2 – (- 2))2   
 = √ (6)2 + (4)2  
 = √ 36 + 16  
 = √ 52  
 = 7.2**